THE NON-PERIODIC DISTRIBUTION OF HEAT IN THE ATMOSPHERE.

By Lorin Blodget.

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The time has at length arrived when we can with some probability of success, open the inquiry as to the causes of the remarkable facts of the Non-Periodic distribution of heat in the atmosphere of the temperate climates; the necessary basis of observed facts being afforded in the extensive series of means of temperature published in various works, chiefly the War Department volumes; and in the recent and most valuable system of the Signal Service.

These extreme non-periodic changes are very remarkable on both sides, that is, those of excessive heat in summer, and those of excessive cold in winter, or in the colder months, since they often occur in other than the technical winter months. So great are the consequences in simply the sanitary point of view, that the National Health Association recently formed, has made them the specific subject of inquiry: and at New York the highly intelligent direction of the Health Commissioners has been directed toward the introduction of special protective measures of a local character to avert the fearful mortality which these periods of excessive heat cause in that city.

In a practical point of view the most urgent desire exists to ascertain whether these excesses, especially of heat, can be indicated or foreshadowed by telegraphic or other agency; whether warning can be given, and care for the preservation of life enjoined. In the extreme Northwest the destruction of life from violent cold is as great as that in New York from extra-tropical heat; and admirable as many features of the present Signal Service are, it does not at present give us any efficient action on the specific point of preparing us for either of these extremes.

In a philosophical point of view the inquiry is broader and more comprehensive. It is a great enlargement of the inquiry in regard to storms, introducing new elements and more important calculations. It appears to be broader in its scope than even the atmospheric circulation which is now so well established, and through which most of the phenomena of the evaporation and precipitation of atmospheric moisture are regularly ordered and instituted. Storms are but incidents of this system of circulation, with its consequences of evaporation in the tropics, and precipitation in the temperate latitudes. We can set bounds to it, and fix its constants with a fair degree of accuracy. The atmospheric movements, whether superficial, or in the superior strata, can easily be reduced to a resultant, and their significance determined almost as positively at the 40th parallel, as can that of the trade winds on the borders of the tropics. The constants of atmospheric precipitation are also of comparatively easy determination, and the sea of water falling in rain and snow can be measured and its depth determined with a close approximation to accu-

racy. So also of the averages or fixed constants of heat; there is little difficulty in reducing all the irregularities disclosed in successive months, seasons or years to determinate values, fixing the isothermal illustration with reasonable precision.

But the great single non-periodic variations of heat are more difficult to grapple with than any other phenomena of their class. They are not traceable, as storms are, from any point of natural initiation, through a moving path of growth to maximum proportions, followed by regnal and natural exhaustion until the equilibrium is restored. An excess of moisture arising in the atmospheric circulation at a colder latitude must be precipitated from the air which can no longer sustain it; and in the course of this natural and inevitable condensation, all the known phenomena of storms are developed. But there are changes of the measure of heat which occur in quite as large a measure wholly independently of any such phenomena, as they do in concurrence with them. Indeed, there are at times extraordinary depressions of temperature departing widely from the normal measures for the month or season in which they occur, which appear to *strike down*—not to be transferred along the surface with any atmospheric movement—and to force from the air every vestige of contained moisture; as if some external compressing force had been applied.

As I have proposed only to open the subject at the present time, I beg to offer a few propositions for consideration rather than to suggest that they are even preliminarily proved. It is a very laborious work to investigate the subject through the rigid processes of induction which can alone establish positive principles. It is easier to indicate some negative determinations; and these are so important, and so much at variance with the analogies of change in the atmospheric problems heretofore investigated, as to induce me to anticipate more conclusive results and present them in this paper. The following are the propositions;

1. The greater non-periodic changes in the measure of heat in the temperate climates of the North American Continent are not connected with or dependant upon the system of atmospheric circulation of these latitudes; nor on the incidents of this system, in the evaporation and precipitation of moisture, nor on the greater phenomena of such precipitation in the form of local or general storms.

2. There is no evidence of movement in these greater changes, either with or against the course of movement belonging to the ponderable elements of the atmosphere.

3. The periods of extreme cold do not come from, or connect with like conditions at the North; they are not transferred from the North Southward; often the reverse is the case, and unusual mildness prevails in observed portions of British America, at the time that almost Arctic severity prevails in much lower latitudes and in various parts of the Northern and Central States.

4. The periods of extreme heat do not come from, or connect with periods of extreme heat at the South.

It is often much cooler at Charleston, Key West, and elsewhere at the South than it is at Baltimore or New York in these cases of excessive heat. And a whole month, as well as a shorter period may exhibit such comparatively cool weather at the points from which it might be inferred that the heat would be transferred to us. In fact, at Charleston and Savannah, the intense heat of the last summer at New York and the North were unknown !—a mean of 85° at the North being reduced there to a mean of 81½° only.

5. These more striking non-periodic extremes, both of heat and cold, appear to be instituted at the districts where they are felt, by or through some superior and extraneous agency, the elements of which are at present extremely difficult of determination.

I beg for the present merely to submit these propositions, as being indicated only, not proved, although much time and observation have been given by me to the consideration of the subject. I shall beg also to submit at an early day, the numerical elements of the investigation as so far conducted.

OSCILLATORY FORCES IN THE SOLAR SYSTEM.

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All material motion seems to be determined by tendencies to equilibrium between elastic, or centrifugal, and attractive, or centripetal forces. It may, therefore, be presumed that every molecular motion can be so connected by simple equations, with solar force, as to furnish an almost endless variety of methods for estimating the Sun's mass and distance.

The solar radiating forces (luminiferous, caloriferous, etc.), are supposed to move with uniform velocities in straight lines. Gravitating motion is uniform only in circular orbits. We may, therefore, reasonably look for the circular ratio, π, among the conditions of planetary equilibrium. The influence of that ratio in positing alternate planetary orbits, is shown in the following table, each of the theoretical terms being obtained by dividing the preceding term by π.

Cardinal Positions in the Solar System.

	Theoretical.	Observed.
Neptune, mean.....	30.04*	30.04
Saturn, "	9.56	9.54
Mars, major axis.....	3.04	3.05
Earth, perihelion.....	.97	.98
Mercury, "	.31	.31

* $\frac{\pi^6}{32}$. If π^n represents the time of revolution in a circular orbit, $\pi^n \div \sqrt{32}$ represents the time of fall from the circumference to the centre.